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E1S SLW3 SP

(56) Documents Cited
GB 0656438 A **NL 001000235 A** **US 5755307 A**
US 5044468 A **US 2598875 A** **US 2552941 A**

(58) Field of Search
UK CL (Edition Q) **E1S SLW3 SP SX**
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(54) Abstract Title
Hydraulic levelling apparatus for ladders and scaffolding

(57) A support apparatus includes at least first and second substantially upright legs (6, 8) and an hydraulic levelling apparatus. The hydraulic levelling apparatus comprises a piston and cylinder assembly (11, 13) provided at the lower end (7, 9) of each of the first and second legs. Each piston and cylinder assembly includes a movable support foot (31) and means (29) for controlling the flow of hydraulic fluid into and out of the piston and cylinder assemblies so as to lower and raise the support feet in order to adjust the attitude of the first and second legs relative to a ground surface.

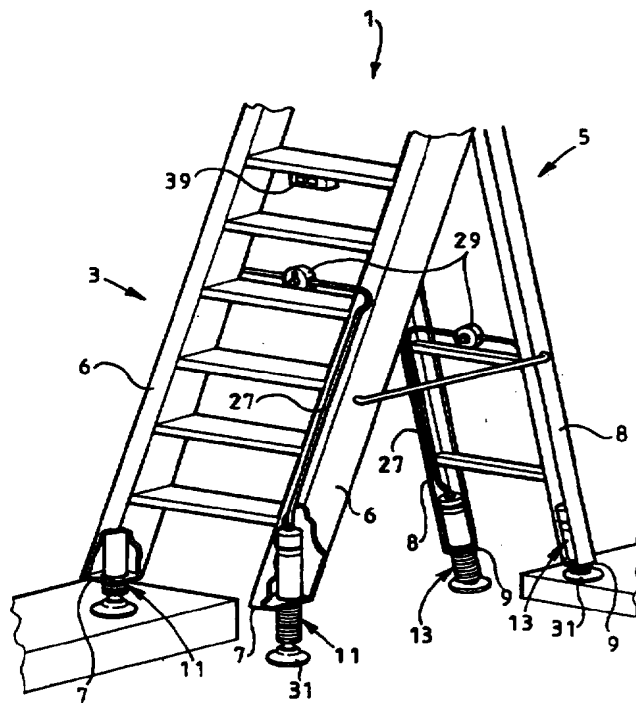


FIG 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

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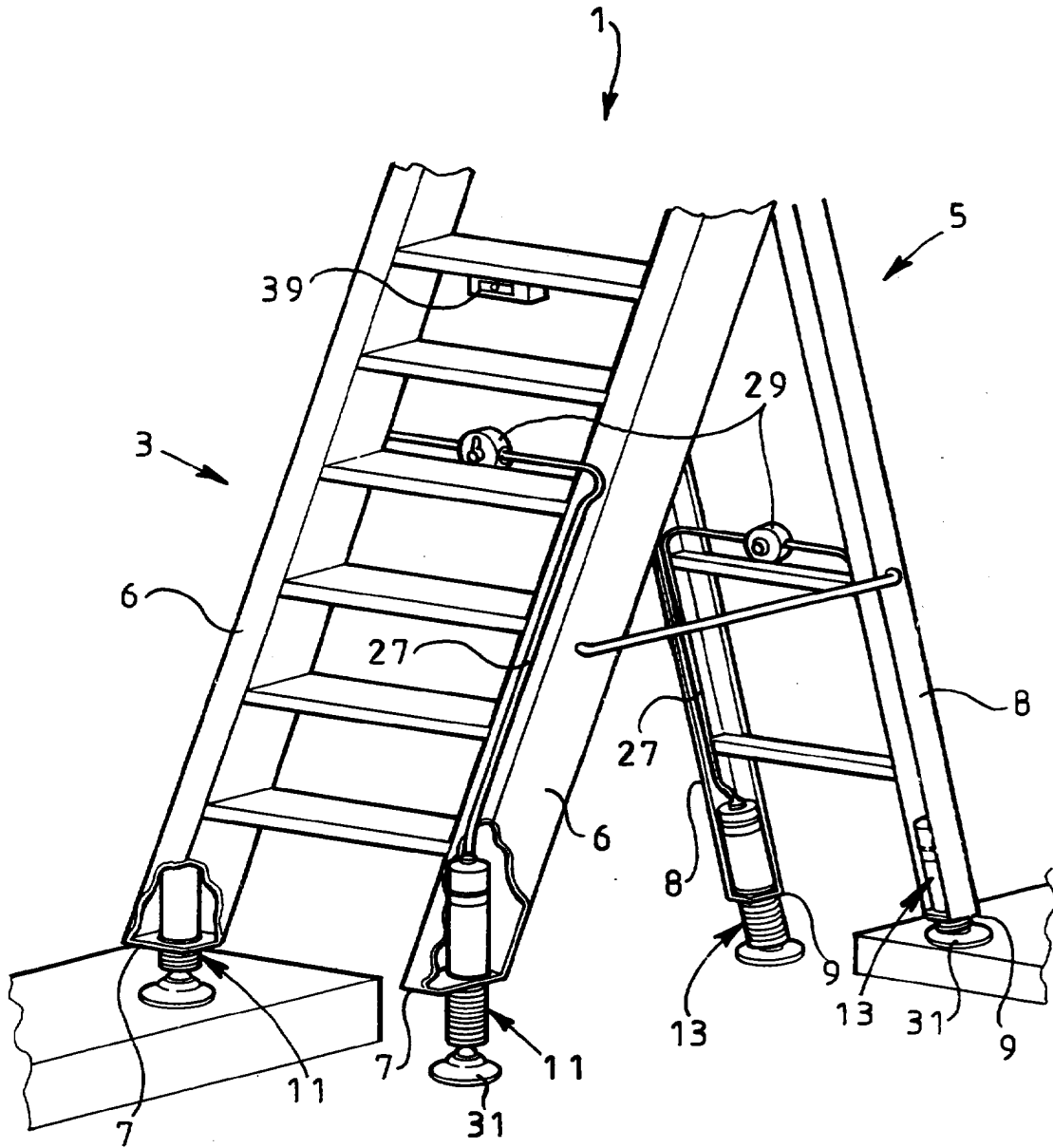


FIG 1

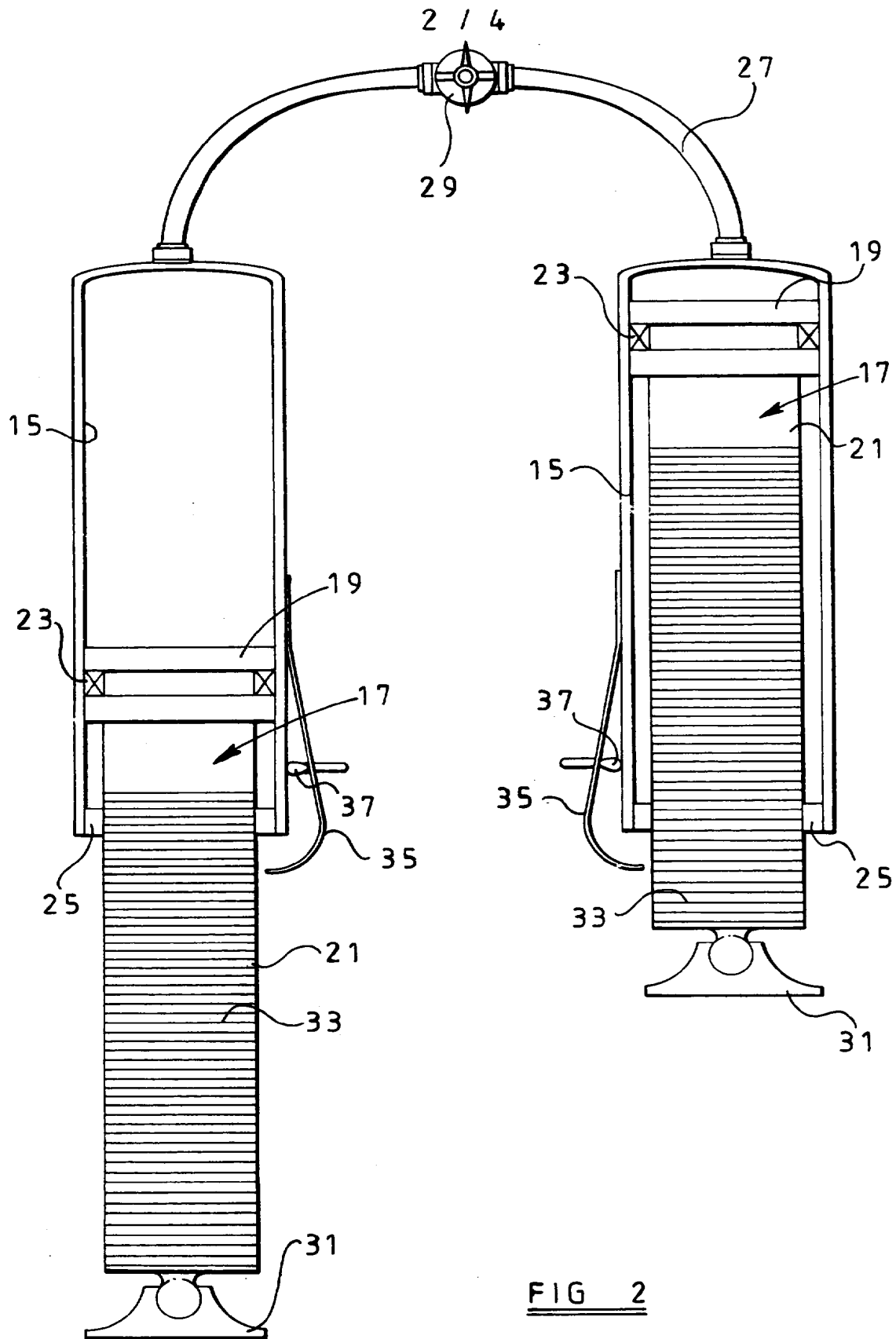


FIG 2

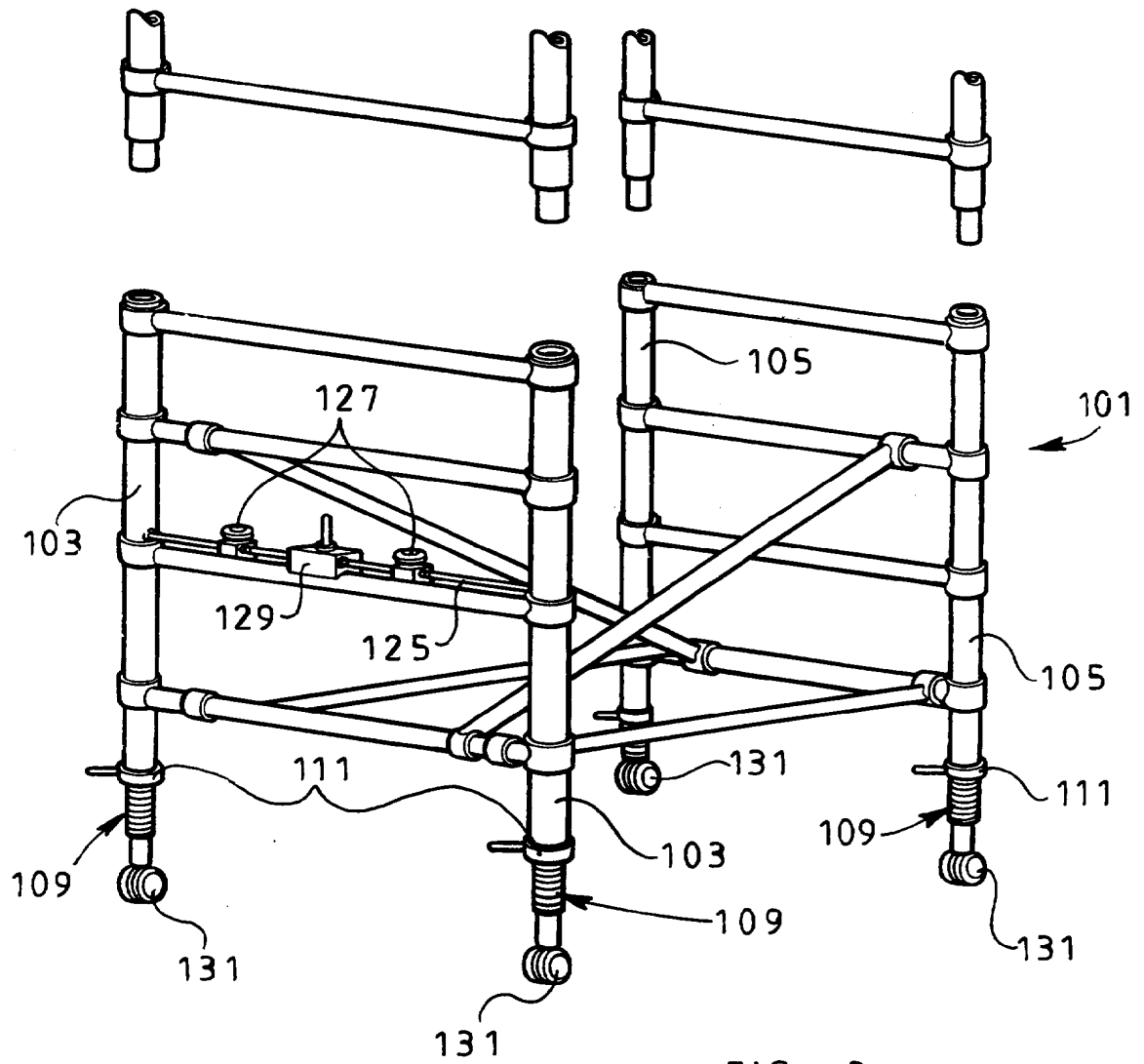


FIG 3

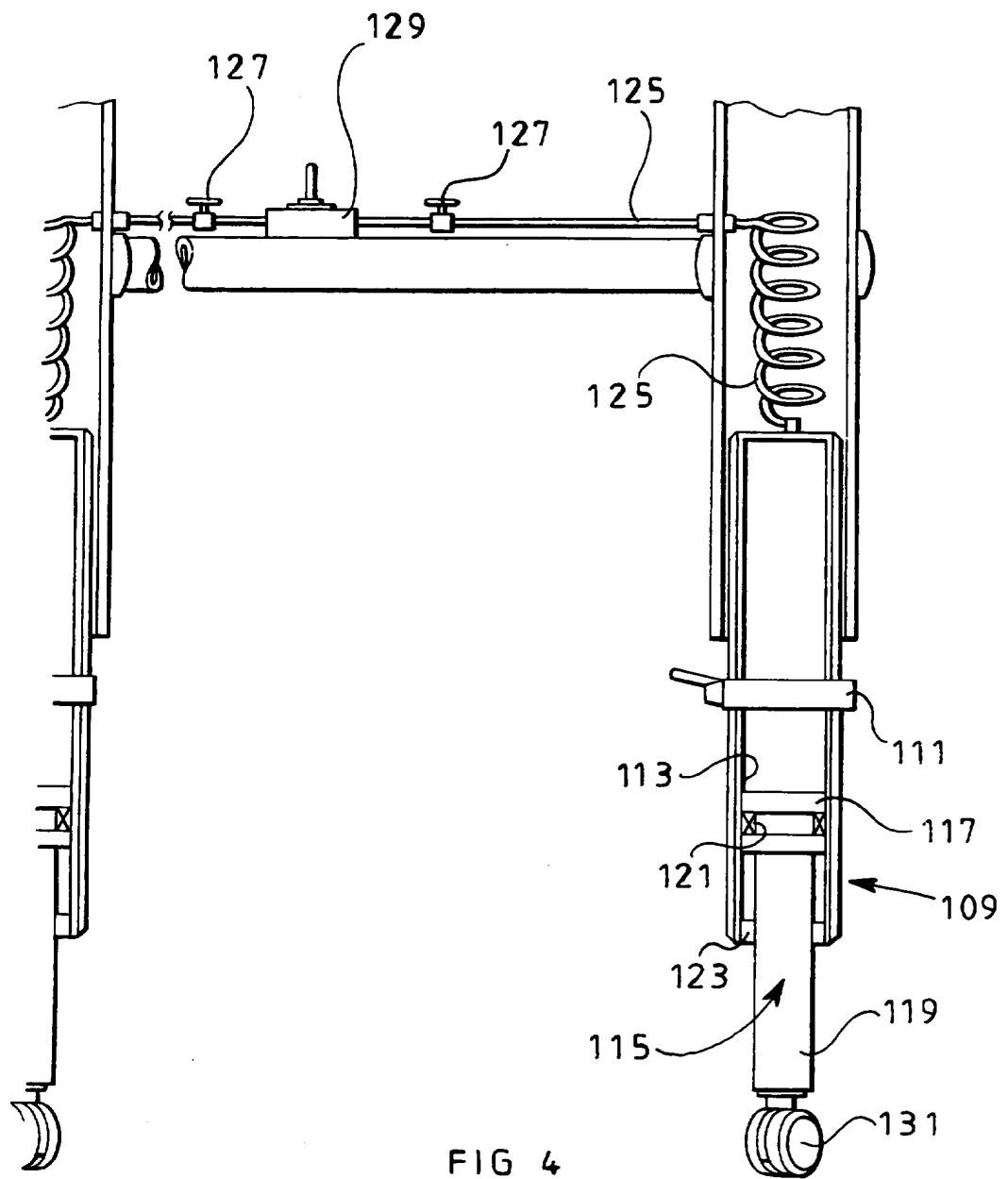


FIG 4

SUPPORT APPARATUS INCORPORATING
HYDRAULIC LEVELLING APPARATUS

5 This invention relates to a support apparatus, such as a
ladder, step ladder or a staging frame, incorporating an
hydraulic levelling apparatus.

10 A problem arises when using ladders, step ladders and
staging frames on uneven ground in that the ladder or the
like tends to tilt sideways and to be unstable, with the
result the ladder is unsafe to use and potentially
dangerous.

15 It is therefore an object of the present invention to
provide a support apparatus incorporating an hydraulic
levelling apparatus which is capable of overcoming, or at
least reducing, this problem.

20 According to the present invention there is provided a
support apparatus including at least first and second
substantially upright legs, the support apparatus being
provided with an hydraulic levelling apparatus comprising
a piston and cylinder assembly provided at the lower end of
each of the first and second legs, each assembly including
25 a support foot movable therewith, and means for controlling
the flow of hydraulic fluid into and out of the piston and
cylinder assemblies so as to lower and raise the support

feet in order to adjust the attitude of the first and second legs relative to a ground surface.

5 The piston and cylinder assemblies may be connected in pairs by way of the flow control means such that the flow of hydraulic fluid into one piston and cylinder assembly is compensated by flow of hydraulic fluid out of the other piston and cylinder assembly.

10 The flow control means may comprise a stop tap and/or pump means such as a manually operable pump.

15 The piston of each piston and cylinder assembly may be provided with releasable locking means for securing the piston relative to the cylinder. The releasable locking means may comprise a plurality of grooves provided externally of the piston for receiving a spring-biased retaining member. A cam lever may be provided for releasing the retaining member from the grooves.

20 The piston and cylinder assemblies may be adjustable relative to the respective leg, for example by way of an external thread formed on the cylinder and carrying a threaded collar thereon for engaging the lower end of the leg.

25

The support apparatus may include means for indicating when the legs are substantially upright.

The support foot may comprise an articulated foot or a castor.

5 The support apparatus may include four substantially upright legs, each provided with piston and cylinder assemblies.

10 For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made, by way of example, to the accompanying drawings in which:

15 Figure 1 is a partial perspective view of one embodiment of a support apparatus according to the present invention in the form of a step ladder incorporating an hydraulic levelling apparatus;

20 Figure 2 is a diagrammatic illustration showing the hydraulic levelling apparatus of Figure 1 in more detail;

25 Figure 3 is a diagrammatic perspective view of another embodiment of a support apparatus according to the present invention in the form of a staging frame incorporating an hydraulic levelling apparatus; and

Figure 4 is a diagrammatic illustration showing part of the hydraulic levelling apparatus of Figure 3 in more detail.

Figures 1 and 2 show a support apparatus in the form of a step ladder 1 having a step portion 3 and a support portion 5. The step portion 3 incorporates a pair of substantially upright legs in the form of side members 6 having lower ends 7 and the support portion 5 incorporates a pair of substantially upright legs in the form of side members 8 having lower ends 9, which lower ends 7, 9 require to be supported on an uneven ground surface.

10 Provided on or in each of the side members 6 is a single-acting hydraulic piston and cylinder assembly 11 and provided on or in each of the side members 8 is a single-acting hydraulic piston and cylinder assembly 13.

15 As can best be seen from Figure 2, each piston and cylinder assembly 11 comprises a smooth bore cylinder 15, for example of steel or a suitable alloy material, having slidably mounted therein a piston member 17. The piston member is provided with an enlarged head portion 19 for engaging closely within the cylinder 15 and with a rod portion 21 which extends out of the cylinder 15 and will be described in more detail hereinafter. The head portion 19 is formed with a circumferential groove for receiving a single-action seal 23 (not shown in detail). That end of the cylinder from which the rod portion 21 extends is provided with a stop and sealing member 25 for retaining the piston member within the cylinder and for minimising

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the ingress of dirt or the like. The other end of the cylinder 15 is closed.

5 The two cylinders 15 are interconnected by a small bore pipe 27, for example of metal or the like, and a stop tap 29 is provided in the pipe 27 intermediate the two cylinders for controlling the flow of hydraulic fluid therethrough. As can be seen from Figure 1, the stop tap 29 is located in a suitable position on the step portion 3, 10 for example to the rear of one of the steps thereof, in order that the tap 29 should not be operated accidentally.

Each rod portion 21 is provided with an articulated foot member 31 at the free end thereof, for example by means of 15 a ball and socket arrangement. Additionally, the surface of the rod portion is formed with a plurality of axially-spaced circumferential grooves 33 for receiving the free end of a spring-biased retaining member 35 which is secured to the external surface of the cylinder 15. The retaining 20 member 35 may be inherently biased due to the nature of the material employed therefor. A cam lever 37 is mounted on the external surface of the cylinder 15 for releasing the retaining member 35 from the grooves 33 and for allowing the retaining member to be biased into engagement with the 25 grooves.

The piston and cylinder assemblies 13 are substantially the same in construction as the piston and cylinder assemblies

11 and the same references are used to denote corresponding parts.

5 In use of the step ladder shown in Figures 1 and 2, the step ladder is placed on a ground surface as required, the levers 37 are moved to a position in which the free end of each retaining member 35 is released from the grooves 33 of the cylinder 15, and the stop taps 29 are moved to a position in which hydraulic fluid is able to flow between
10 the two cylinders 15 by way of the pipe 27. In this way, both the step portion 3 and the support portion 5 can be adjusted to a stable substantially upright configuration (that is, without the portions 3, 5 leaning to one side such that the step ladder is unstable, or potentially so),
15 with one of the pistons moving towards the free end of the respective cylinder as the other of the pistons moves towards the closed end of its respective cylinder and vice versa. The user is able to determine when this has been achieved with a spirit level 39. When the step ladder is
20 in the desired configuration, the stop taps 29 are moved to a position in which hydraulic fluid is unable to flow between the cylinders 15, thereby effectively locking the pistons in position.

25 The free ends of the retaining members 35 are then permitted to enter into one of the circumferential grooves 33 formed in each of the rod portions 21 by operating the cam lever 37. The retaining members 35 thus lock the rod

portions 21 in position and act as safety devices in the unlikely event of a failure in the hydraulic systems.

Clearly, for a ladder only two interconnected cylinders 15 would be required.

As an alternative (not illustrated) to the two cylinders of each hydraulic system being interconnected, each cylinder can be connected to a reservoir for hydraulic fluid by way of a pipe provided with a stop tap. Movement of the piston within the respective cylinder causes hydraulic fluid to flow between the cylinder and the reservoir and the stop tap can be used to control the flow of fluid substantially as described above.

15 Figures 3 and 4 show a support apparatus in the form of a staging frame 101 having two pairs 103, 105 of upright legs which are interconnected to form a rectangular frame. Conventionally, each upright leg is provided with an externally threaded cylinder slidably mounted within the lower end thereof and with a collar threaded on the external surface of the cylinder and engaging against the lower end of the leg. In this way, rotation of the collar serves to adjust the length of the respective leg and to allow the staging frame to be levelled. The disadvantage of this arrangement is that adjustment is relatively time consuming and is often not undertaken unless absolutely

essential, with the result that the staging frame is often used in a configuration in which the legs are not upright.

5 In the illustrated embodiment, each upright leg 103, 105 is provided with an externally threaded single-acting hydraulic piston and cylinder assembly 109, the cylinder assembly being slidably mounted within the lower end of the upright leg. A collar 111 is threaded on the external surface of the cylinder assembly and is provided with one
10 or more protrusions for rotating the collar relative to the cylinder for adjustment of the base of the upright leg. In the illustrated embodiment, the collar 111 is employed for coarse adjustment of the staging and often will not require to be used.

15 Each piston and cylinder assembly 109 comprises a smooth bore cylinder 113 having slidably mounted therein a piston member 115. The piston member is provided with an enlarged head portion 117 for engaging closely within the cylinder
20 113 and with a rod portion 119 which extends downwardly out of the cylinder 113. The head portion 117 is formed with a circumferential groove for receiving a single-action seal 121. That end of the cylinder from which the rod portion 119 extends is provided with a stop and sealing member 123
25 for retaining the piston member within the cylinder and for minimising the ingress of dirt or the like. The other end of the cylinder 113 is closed.

As mentioned above, the external surface of the cylinder 113 is threaded for receiving adjusting collar 111, which collar in turn bears against the lower end of the respective leg 103, 105.

5

The cylinder and piston assemblies in each pair of legs 103, 105 are interconnected by a small bore pipe 125, a portion of the pipe within each leg being flexible and arranged in a coil to allow for adjustment by means of the collar 111. Provided in the pipe 125 are two stop taps 127 and a manual pump 129 for operating the piston and cylinder assemblies because of the relatively high weight of the staging frame 101.

10
15 Each rod portion 119 is provided with a castor 131 at the free end thereof to facilitate movement of the staging frame.

20 Use of the staging frame shown in Figures 3 and 4 is similar to the step ladder as described above, except for the additional adjustment provided by the collars 111 and the pump for levelling the frame. It is therefore not necessary to describe the use of the staging frame in more detail.

CLAIMS

1. A support apparatus including at least first and second substantially upright legs, the support apparatus being provided with an hydraulic levelling apparatus comprising a piston and cylinder assembly provided at the lower end of each of the first and second legs, each assembly including a support foot movable therewith, and means for controlling the flow of hydraulic fluid into and out of the piston and cylinder assemblies so as to lower and raise the support feet in order to adjust the attitude of the first and second legs relative to a ground surface.
2. A support apparatus as claimed in claim 1, wherein the piston and cylinder assemblies are connected in pairs by way of the flow control means such that the flow of hydraulic fluid into one piston and cylinder assembly is compensated by flow of hydraulic fluid out of the other piston and cylinder assembly.
3. A support apparatus as claimed in claim 1 or 2, wherein the flow control means comprises a stop tap.
4. A support apparatus as claimed in claim 1, 2 or 3, wherein the flow control means comprises pump means.

5. A support apparatus as claimed in claim 4, wherein the pump means comprises a manually operable pump.
- 5 6. A support apparatus as claimed in any preceding claim, wherein the piston of each piston and cylinder assembly is provided with releasable locking means for securing the piston relative to the cylinder.
- 10 7. A support apparatus as claimed in claim 6, wherein the releasable locking means comprises a plurality of grooves provided externally of the piston for receiving a spring-biased retaining member.
- 15 8. A support apparatus as claimed in claim 7, wherein a cam lever is provided for releasing the retaining member from the grooves.
- 20 9. A support apparatus as claimed in any preceding claim, wherein the piston and cylinder assemblies are adjustable relative to the respective leg.
- 25 10. A support apparatus as claimed in claim 9, wherein the piston and cylinder assemblies are adjustable by way of an external thread formed on the cylinder and carrying a threaded collar thereon for engaging the lower end of the leg.

11. A support apparatus as claimed in any preceding claim and including means for indicating when the legs are substantially upright.
- 5 12. A support apparatus as claimed in any preceding claim, wherein the support foot comprises an articulated foot.
- 10 13. A support apparatus as claimed in any one of claims 1 to 11, wherein the support foot comprises a castor.
14. A support apparatus as claimed in any preceding claim and including four substantially upright legs, each provided with piston and cylinder assemblies.
- 15 15. A support apparatus substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.



Application No: GB 9816726.5
Claims searched: 1-15

Examiner: Peter Mason
Date of search: 6 December 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): E1S: SP, SX, SLW3

Int Cl (Ed.6): E04G, E06C

Other: Online: PAJ, WPI, EPODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB656438	RINK	1-3,12
X	US5755307	DUNNEWIN et al.	1-3
X	US5044468	WORTHINGTON	1-,3,12
X	US2598875	ANDERSON (see figs.)	1-3,12
X	US2552941	COURTNEY (see figs.)	1-3,12
X	NL1000235 C	BAIS (see figs. And WPI abstract)	1-3,14

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.